MEMORANDUM

November 19, 2004

FOR: FCRPS Remand File

FROM: Paul Wagner

SUBJECT: Transport Operations Protocol for the BiOp Gap Analysis

Proposed Action Transport Operations

The AA's proposed hydro operation transportation protocol for juvenile Snake River salmonids called for the following actions:

In years when the seasonal average Snake River flow at Lower Granite is expected to be less than 70 kcfs, maximum collection of transportation will occur from the date the juvenile bypass systems begin operation. Due to the mixed benefits of early season transport, however, collection for transport will not be initiated until April 20 in those years where average seasonal flows are expected to equal or exceed 70 kcfs. Prior to April 20, all collected fish will be bypassed back to the river. In those years where flows are anticipated to be between 70 and 85 kcfs, spill will be provided at the collector projects until April 20. Further investigations into spill patterns (e.g. large gate openings/bulk spill) that provide optimum spillway survival conditions in these lower flow conditions will be coordinated through the Corps' FFDRWG process.

A summary table of the AA's proposed action for transportation spring juvenile migrants at lower Snake River collector dams.

	< 70 kcfs	**70-85 kcfs**	**> 85 kcfs**
Transport	Maximize	Initiate Collection April 20	Initiate Collection April 20
Bypass	None	Bypass Through April 19	Bypass Through April 19
Spill	None	Spill Through April 20	Spill Through June 20

This modified proposal incorporates recently compiled transport study results which includes the finding of Williams et al. who noted a lack of a consistent benefit provided from juvenile fish transport during much of April for wild juvenile SR spring chinook (NOAA, 2004). Williams et al. (NOAA, 2004) stated that, "for wild yearling Chinook salmon and steelhead, in almost all cases fish transported after 1 May returned at similar or higher rtes than fish that migrated through the FCRPS reservoir and dams. In some years, fish transported as early as 15-20 April returned at higher rates than in-river fish, but hot consistently" (NOAA 2004). Based on these findings and similar findings reported by Anderson, (Anderson et al. 2004), the Action agencies adopted April 20 as a date to commence transport operations when spring seasonal average flow (April 3 – June 20) at Lower Granite dam is projected to exceed 70 kcfs.

The summer transportation protocol remained unchanged from the 2000 FCRPS operation which called for no spill and maximum collection of fall Chinook at both the lower Snake River collector projects and McNary Dam beginning approximately June 20.

Reference Transport Operations

As a result of the use of PIT-tag technology, spring transport studies conducted from 1995 through 2001 have yielded much more comprehensive information about the effects of transportation. Also, efforts have been made over the years to provide adequate passage conditions for in-river migrants by managing both spill and flow in the mainstem migration corridor. Adequate migration conditions for fish that remain in-river are essential for them to serve as a suitable control group. The findings of these studies are summarized and presented in Williams *et al.* (2004).

Following is a brief summary of NOAA Fisheries' Hydro Division's interpretation of the management implications drawn from Williams *et al.* (2004):

(1) There appears to be little consistent benefit provided to wild SR spring chinook by transportation.

(2) There appears to be a benefit provided to hatchery SR spring chinook by the transportation program. That benefit is most significant after May 1.

(3) There appears to be a benefit provided to both wild and hatchery SR steelhead from the transportation program.

(4) The benefit from transportation increases through the spring. The benefit from transportation during the month of April appears to be negligible.

(5) The benefit provided to SR fall chinook from transportation does not appear significant. However, this conclusion is based on limited preliminary data.

Decisions on transportation need to be made in the context of how in-river conditions affect the survival of juvenile migrants. New information presented in Williams *et al.* (2004) develops the concept that flow/survival thresholds likely exist for both SR steelhead and SR spring chinook. The flow value for maximum survival of spring chinook in the Snake River was calculated to be 73 kcfs, with a 95% confidence interval (C.I.) range of 70 - 99 kcfs. The Snake River flow for the maximum survival of steelhead was calculated to be 115 kcfs, with a 95% C.I. range of 79 - 133 kcfs. The management implication of this information is that transportation would be beneficial to these fish when the lowest range of these flow thresholds will not be met on a seasonal average basis. Applying this information to develop a management strategy for transportation operations took the following considerations into account.

(1) The value of transporting migrants before May 1 is negligible. However, the effect of bypassing fish collected at dams multiple times may be negative as well. A method to manage this uncertainty is to provide a spill operation to leave a significant percent of the fish to migrate in river, but to transport those fish that are collected. A recent report

by Anderson *et al.* (Anderson et al., 2004) indicates that hatchery spring Chinook collected and transported after April 22 show a higher rate of return than fish left to migrate in-river.

(2) The Lowest flow years result in low in-river survival, particularly for steelhead. Therefore a threshold flow was chosen at which all fish should be transported and no spill provided. Williams et al.'s regression analysis indicated the lower range for a modeled threshold flow/ survival relationship was 70 kcfs for spring Chinook and 79 kcfs for steelhead in the lower Snake River (Williams et al 2004). A 70 kcfs flow equates to approximately the lowest 15% of annual runoff conditions for the Lower Snake River. A reasonable management strategy to draw from this observation is to maximize transportation during the years when seasonal average flows at Lower Granite Dam are projected to be less than 70 kcfs. This is accomplished by not spilling at the collector projects, and transporting all fish collected. It is assumed that, below this seasonal average flow level, maximum survival would be achieved by maximizing transportation.

(3) When seasonal average flows at Lower Granite Dam are projected to range between 70 and 85 kcfs, spill would be provided at all Lower Snake River projects until May 1. After that date, spill would be terminated and all non-study fish collected would be transported. The rationale for this operation is that, since wild SR spring Chinook demonstrate no consistent benefit from transportation early in the season, they should remain in-river to the extent possible. Conversely, these flows will be near the low end of the estimated 95% C.I. survival threshold for SR steelhead. This operation would provide in-river passage for spring chinook during April but would switch to a maximum transportation strategy to benefit steelhead in May, when they will likely be a large percentage of fish collected.

(4) When seasonal average flows at Lower Granite Dam are projected to exceed 85 kcfs, provide spill on a 24-hour basis at all collector projects throughout the spring season. This operation is a "spread-the-risk" strategy where some fish are transported and some remain in-river. This operation is important to maintain for wild spring Chinook, which have not shown any consistent benefit from transportation

(5) There would be no transportation form McNary Dam in the spring except for tagged fish being used to evaluate transportation from this facility.

(6) The reference operation calls for no spill at all collector projects throughout the summer season (June 21 - September 15). This is consistent with the current transport strategy for SR fall chinook, which calls for maximizing collection and transportation. This strategy is also consistent with the conclusion that "No empirical evidence exists to suggest that transportation either harms or helps fall chinook salmon" (Williams *et al.* 2004). Due to the lack of available information, and as called for in the 2000 FCRPS Biological Opinion, a formal in-river transport study evaluating whether any benefit exists from transporting fall chinook remains a high priority. This study should be

performed with spill to provide adequate in-river passage conditions for non-transported fish.

The following table summarizes the transport operation specified for spring migrants in the reference operation. The AA's proposed action was similar to the reference operation in many respects. The only differences were the early season management of collected fish (transported vs. returned to the river) and the date at which spill was terminated in 70-85 kcfs flow years (April 20 vs. May 1).

Summary table of reference operation transportation protocol for spring juvenile migrants at lower Snake River collector projects.

	< 70 kcfs	**70-85 kcfs**	**> 85 kcfs**
Transport	Maximize	Initiate Collection April 1	Initiate Collection April 1
Bypass	None	None	None
Spill	None	Spill Through May 1	Spill Through June 20

Literature Cited

Anderson, J. J., R. A. Hinrichsen, C. Van Holmes, K. D. Ham. 2004. Historical analysis of PIT tag data for transportation of fish at Lower Granite, Little Goose, Lower Monumental, and McNary Dam. Prepared for: U.S. Army Corps of Engineers, Walla Walla District, Walla Walla, Washington. Draft report.

Williams, John G., S. G. Smith, R. W. Zabel, W. D. Muir, M. D. Scheurell, B. P. Sanford, D. M. Marsh, R. McNatt, S. Achord. Effects of the Federal Columbia River power system on salmon populations. October 7, 2004 draft. U.S. Department of Commerce.